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Foliar Application of Humic Acid on Plant Height in Canola

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Abstract

Humic acid is a principal component of humic substances, which are the major organic constituents of soil. In order to the foliar application of humic acid on plant height in canola spring cultivar (RGS-003 cul.), this experiment was conducted in 2012 at Islamic Azad University Shahr-e-Qods Branch in Tehran by a completely randomized design with four replications. The factors studied included foliar application of humic acid (Control, 0.5, 1, 1.5 and 2%) that sprayed in three stages (stem elongation, flowering stage and silique formation stage). The results showed that foliar application of humic acid significantly affected plant height and highest this parameter was achieved under 2% foliar application of humic acid and the lowest plant height was obtained under control conditions. Also, means comparison showed that plant height under 0.5% foliar application of humic acid and 1% foliar application of humic acid were in a similar statistical group. The results showed that foliar application of humic acid decreased nitrogen application in soil, that can be the most important for the non-pollution of soil by nitrogenous fertilizers.

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Keywords: Humic acid, Foliar application, Plant height, Canola spring cultivar

1. Introduction

Humic acid can be extracted from any material containing well-decomposed organic matter - soil, coal, composts, etc. Extraction is by way of treatment of these materials with a solution of sodium hydroxide. This dissolves much of the organic matter present. If we then take this solution and add enough acid to drop its pH to about 2, organic material will begin to flocculate and can be separated from the liquid portion (Kussow, 2002). In the an experiment, humic acids were extracted from pig manure vermicompost using the classic

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alkali/acid fractionation procedure and mixed with a soilless container medium (Metro-Mix 360), to provide a range of 0, 50, 100, 150, 200, 250, 500, 1000, 2000, and 4000 mg of humate per kg of dry weight of container medium, and tomato seedlings were grown in the mixtures. In the next experiment, humates extracted from pig manure and food wastes vermicomposts were mixed with vermiculite to provide a range of 0, 50, 125, 250, 500, 1000, and 4000 mg of humate per kg of dry weight of the container medium, and cucumber seedlings were grown in the mixtures. Both tomato and cucumber seedlings were watered daily with a solution containing all nutrients required to ensure that any differences in growth responses were not nutrient-mediated. The incorporation of both types of vermicompost derived humic acids, into either type of soilless plant growth media, increased the growth of tomato and cucumber plants significantly, in terms of plant heights, leaf areas, shoot and root dry weights. Plant growth increased with increasing concentrations of humic acids incorporated into the medium up to a certain proportion, but this differed according to the plant species, the source of the vermicompost, and the nature of the container medium. Plant growth tended to be increased by treatments of the plants with 50–500 mg/kg humic acids, but often decreased significantly when the concentrations of humic acids derived in the container medium exceeded 500–1000 mg/kg. These growth responses were most probably due to hormone-like activity of humic acids from the vermicomposts or could have been due to plant growth hormones adsorbed onto the humates (Atiyeh et al., 2002). In a field study, the growth, yield and oil content of three mustard varieties viz., S-9, P-78 and AH-2001 were observed under varying levels of humic acid application to a poorly fertile and alkaline-calcareous soil. The humic acid was applied to soil at the time of sowing @ 0, 3.17, 6.35, and 9.35 kg acre-1. Overall varieties, compared to control, the application of humic acid @ 6.35 kg acre-1 positively affected almost all the growth and yield parameters. It is evident from the data that the effect of humic acid levels and interaction of humic acid levels x varieties for plant height was significant ($p<0.05$). While overall humic acid rates, the difference among varieties for plant height was not-significant ($p>0.05$). The results further revealed that compared to control, the application of humic acid resulted in significantly taller plants. The statistical analysis also showed that compared to the untreated plants, the difference within the humic acid application rates was not-significant ($p>0.05$) (Rajpar et al., 2011). A pot experiment was conducted to investigate the effect of mycorrhizal fungi inoculation and humic acid on growth, chlorophylls and total carbohydrates content of *Acacia saligna* Labill. seedlings under different irrigation intervals. The seedlings were subjected to four irrigation intervals (I1, I2, I3 and I4) where the seedlings were irrigated every 3or 5days (I1), every 5or8 days(I2), every 7or11days (I3) and every 9or 14 days(I4) according to the climatic conditions. Results showed that that prolonging the irrigation intervals had negative effects on plant height, fresh and dry weights of leaves, stems and roots and total carbohydrates content in leaves and stems and the opposite trend was recorded in the root. Mycorrhizal fungi inoculation had significantly positive effects than humic acid on plant height, stem diameter, leaf area, fresh and dry weights of stems and roots, chlorophyll content and total carbohydrates content in all seedling parts, while humic acid treatment gave the highest fresh and dry weights of leaves under all irrigation treatments. The irrigation treatment I1 combined with humic acid gave the highest values of plant height, fresh and dry weights of leaves. While mycorrhizal inoculation combined with I1 or I2 gave the highest values of leaf area, stem and roots fresh and dry weights, chlorophyll a, b, carotenoids content and total carbohydrates content in leaves and stems. The highest total carbohydrates in the roots was obtained with humic acid treatment combined with irrigation interval I3 (El-Khateeb et al., 2011). To study the effect of humic acid on yield and yield components of marigold, a complete randomized experiment with 5 levels of humic acid treatments (0, 500, 1000, 2000, 4000 mgl-1) with 3 replications and 15 experimental plots was carried out. Analysis of variance showed that the effect of humic acid treatments on number of leaves and flowers, dry weight and plant height was significantly at the 1% probability level. Mean comparisons revealed that treatment with 2000 mgl-1 humic acid, had the most dry weight, plant height, leaves and flowers number (Mohammadipour et al., 2012). The interactions between earthworms and microorganisms can produce

significant quantities of plant growth hormones and humic acids which act as plant regulators. Experiments were designed to evaluate the effects of humic acids extracted from vermicompost and compare them with the action of commercial humic acid in combination with a commercial plant growth hormone, indole acetic acid (IAA) which is a commonly found in vermicomposts. In the first experiments, humic acids were extracted from cattle, food and paper waste vermicomposts. They were applied to a plant growth medium, Metro-Mix360 (MM360), at rates of 0, 250 or 500 mg humates kg−1 dry wt. of MM360, to marigold, pepper, and strawberry plants in the greenhouse. Substitution of humates ranging from 250 to 1000 mg kg−1 MM360 increased the growth of marigold and pepper roots, and increased the growth of roots and numbers of fruits of strawberries significantly. In other experiments, humic acids extracted from food waste vermicomposts were applied at a rate of 500 mg kg−1 dry wt. of MM360, singly or in combination with IAA at a rate of 10−5 μM, to pepper seedlings. This experiment was designed to compare the differences in effects between the most effective dosage rate of humic acid from food waste, a phytohormone (IAA), and a commercial source of humic acid. The numbers of pepper flowers and fruits increased significantly in response to treatment with humic acid, IAA and a combination of humic acid and IAA. Peppers treated with humic acids extracted from food waste vermicomposts produced significantly more fruits and flowers than those treated with commercially-produced humic acids (Arancon et al., 2006). Therefore, the objective of this study was to evaluate the foliar application of humic acid on plant height in canola spring cultivar in Iran at 2012.

2. Material and Methods

In order to the foliar application of humic acid on plant height in canola spring cultivar (RGS-003 cul.), this experiment was conducted in 2012 at Islamic Azad University Shahr-e-Qods Branch in Tehran by a completely randomized design with four replications. The factors studied included foliar application of humic acid (Control, 0.5, 1, 1.5 and 2%) that sprayed in three stages (stem elongation, flowering stage and silique formation stage). The field was prepared in a 6 m^2 area (3 m × 2 m). At the end of growth stage, 10 plants per plot were for the determination of plant height. Data were subjected to analysis of variance (ANOVA) using Statistical Analysis System [SAS, 1988] and followed by Duncan's multiple range tests. Terms were considered significant at $P < 0.05$.

Table 1. Analysis of variance

Sources of Variation	df	Means Square
		Plant height
Replication	3	7.362*
Animal mature (A)	4	3.337**
Error a	12	0.02
CV (%)		3.51
* and ** : Significant at 5% and 1% levels respectively		

3. Results and Discussion

The results showed that foliar application of humic acid significantly affected plant height and highest this parameter was achieved under 2% foliar application of humic acid and the lowest plant height was obtained under control conditions. Also, means comparison showed that palnt height under 0.5% foliar application of humic acid and 1% foliar application of humic acid were in a similar statistical group (Table 1, 2 and Figure 1). By the application of humic substance to plants, the growing plants are supplied with food, its application

also results in productive and fertile soil, which increase the water holding capacity of soil. It plays a pivot role in making the plants more resistant against drought stress, and also stimulates germination. The application of humic reduces the requirement of other fertilizers. It also increases crop yield, soil aeration, and drainage can also be improved by humic, the establishment of desirable environment for the development of microorganisms. Increase in the protein and mineral contents of most crops is possible by the application of humic substances. The application of humic substances increased the yield in soybeans, potatoes, and algae cultures. It also plays an important role in increasing the fruit yield, also the quality of squash plants are increased by humic substances application. 100% increase in the yield of potatoes and cabbage can be achieved by combined application of NPK fertilizers and humics (Syabryai et al., 1965). At a field experiments were conducted during the two successive seasons of 2009 and 2010 in the Experimental Station of the National Research Centre in El-Nobaria region, Behira Governorate, North Egypt, to study the effect of humic acid (0, 1, 2 and 3 g/L) and bio-stimulators (0.45 cm/L Ecormon, 0.60 g/L Amcotone and 0.60 g/L Tchnotone) as foliar sprays on growth, fruit-set, yield and quality of cucumber plants (*Cucumis sativus* L.) cv. Beta-Alpha (Quartz F1). Cucumber plants were sprayed three times at 15 day intervals with different concentrations of humic acid and bio-stimulators three weeks after planting. Recorded data showed that all morphological characters parameters including plant height, number of leaves and stems/plant, fresh weights of leaves/plant as well as yield and its components of cucumber plants showed positive and significant responses with the high concentration of humic acid (3 g/L) and Ecormon (0.45 cm/L) compared with other treatments. Application of foliar sprays of humic acid (HA) and bio-stimulators led to positive effect on plant growth, fruit set and improvement production of cucumber plants. On the other hand, results showed that total chemical contents percentage (N, P, K, Ca and Mg) in leaves of cucumber plants increased with increasing the amount of humic acid level (3 g/L) and Ecormon (0.45 cm/L) (El-Nemr et al., 2012). Also, in study of Hagag et al (2011) was carried out on cultivated Egazy olive transplants grown at the greenhouse of National Research Center, Dokki, Giza, Egypt. The investigation aimed to study the effect of applying NPK, humic substance on vegetative growth of Egazy olive seedlings planted in plastic bags at nursery stage. After planting Egazy olive seedlings, the following treatments were applied: T1: NPK (Crystalon 20% N: 20% P: 20% K) at four rates (0, 25, 37.5 and 50 g \ plant \ year), T2: humic substance (Potash actosol) at four rates (0, 2, 4 and 6 cm \ plant \ year), also the interaction between NPK, humic substance tr 3 eatment were studied. At the end of the season, percentage of plant height increment, leaves number per plant, shoot numbers per plant, stem diameter, leaves dry weight %, root numbers, root length were determined and recorded. The obtained results revealed that treatment (4 cm3 humic substance only) was the most effective one compared with the other treatments. Since this treatment gave the best results concerning percentage of plant height increment, lateral shoot number per plant, leaves number per plant, stem diameter, also it increased leaves dry weight % comparing with the control. On the other hand, the highest root number was recorded from Egazy olive seedlings not fertilized with NPK and/or humic substance. While, the highest root length value was obtained by using 2cm3 humic substances without NPK. Also, Two field experiments were performed during two winter seasons of 2007/2008 and 2008/2009 at the Agricultural Research Station, Faculty of Agriculture, Alexandria University, Egypt to assess the effect of two inoculation treatments of a biofertilizer (Halex-2) and three numbers of sprays with humic acid on plant growth, productivity, bulbs quality and storability of the most common garlic cultivars in Egyptian market; Balady and Chinese. The obtained results reflected generally that Balady cultivar surpassed than Chinese cultivar in plant height, total yield and shelf-life characters. The higher yield that observed in Balady cultivar was related to the increase cloves number/bulb over than Chinese one. However, Chinese cultivar showed superior performance in bulb weight trait either at harvest or after storage as a result of increasing both cloves weight and diameter more than Balady cultivar. Inoculated garlic plants with Halex-2 and sprayed with humic acid for two times showed superior effect for increasing garlic productivity. However, sprayed inoculated plants for three times via humic acid gave best

results for garlic longevity throughout increasing bulbs weight and decreasing bulbs weight loose after four months of storage (Abdel-Razzak and El-Sharkawy, 2013).

Table 2. Means comparison

Treatment	Plant height (cm)
Control	43.25 d
0.5 %	46.25 c
1 %	47.5 c
1.5 %	49.3 b
2 %	62.25 a
Means within the same column and rows and factors, followed by the same letter are not significantly difference (P<0.05)	

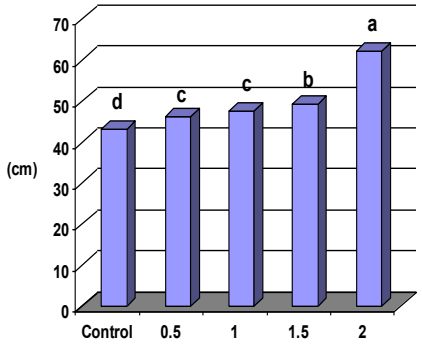

Fig. 1. Effect of application of humic acid on plant height

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